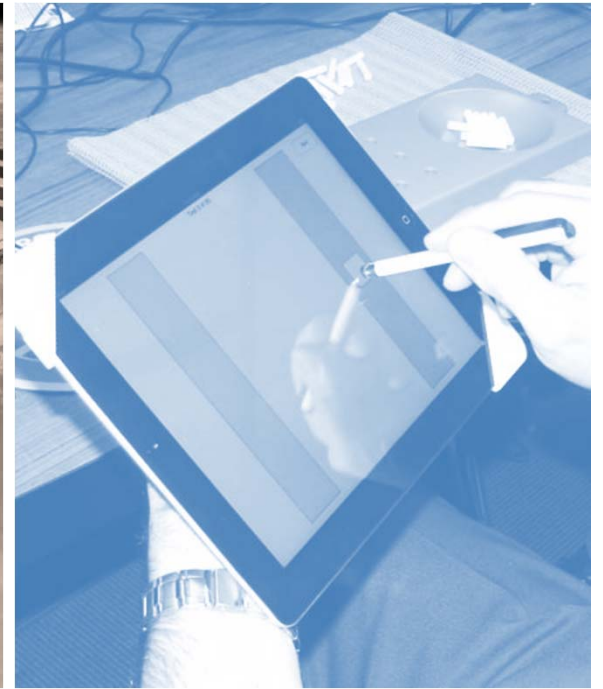
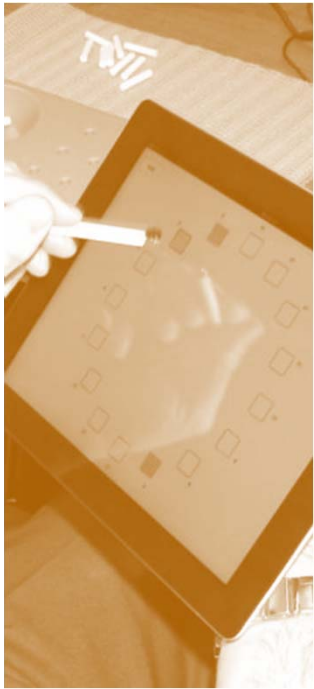


# Effects of Long-Duration Microgravity on Fine Motor Skills

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# Overview of Study

- Fine motor skills will be critical during and after long-duration missions, particularly those skills needed to interact with technologies in next-generation vehicles, spacesuits, and habitats.
- Studies to date have not been comprehensive or conclusive regarding the effects of microgravity on fine motor performance.
- The aim of the current study is to examine the effects of long-duration microgravity and gravitational transitions on fine motor performance. We want to be sure crewmembers will be ready to perform after a long-duration voyage and transition to surface operations.
- Two 1-year crewmembers, matched ground subject(s), and additional crewmembers from concurrent standard duration missions will be asked to complete 4 fine motor tasks approximately weekly during their missions.



# Objectives

- Objective 1:
  - Determine the effects of long-duration microgravity on fine motor performance.
    - How does fine motor performance in microgravity vary over the duration of a year-long and six-month space missions?
    - How does motor performance on orbit compare with that of a matched ground subject?
- Objective 2:
  - Determine the effects of different gravitational transitions on fine motor performance.
    - How does performance vary before and after gravitational transitions, including the periods of early flight adaptation, and early, near-immediate post-flight periods?



# Fine Motor Skill Hardware and Software

- Data collection will be completed using the Fine Motor Skill Application on an iPad.
  - Native iPad application is being installed on new iPads sent to the ISS.
  - Application presents instructions, tasks, and questionnaires.
- A custom handhold for the iPad will aid in stable, standard positioning for all sessions across subjects.
- Study team support as needed – on call for questions or issues, available via email anytime.
- Current plan is to send data to ISS server; team is expecting weekly data downloads.



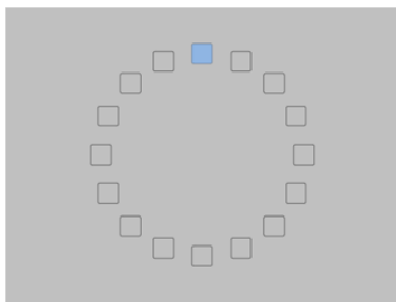
# Requested Data Collection

- Familiarization session (~L-90)
- Pre-flight
  - 4 times within L-90 to L-60
- Flight
  - As soon as possible, but no later than FD 2, 5, and then every 5 days for the first 4 months and every 10 days for the rest of the flight (+/- 2 days). The last session should be within R-7.
- Post-flight
  - On stopovers at airports (R+0), R +1, +3, +5, +15, +30
- Data collection will take approximately 15 min per session; 10 min sessions for R+0, R+1, R+3

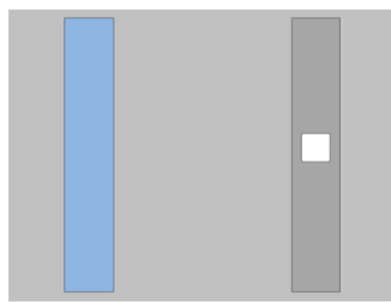
# Fine Motor Skills Tasks

Sessions will consist of:

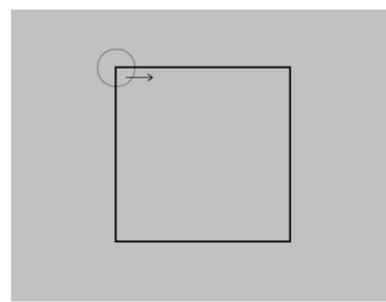
1. Unstowing the iPad with handhold and stylus. (5 min)
2. Completing a Fine Motor software session. (15 min)
  - Test battery of 4 tasks which examine speed/response time, and accuracy. The tasks are: a pointing task, a dragging task, a shape tracing task, and a pinch-rotate task. There will also be a brief questionnaire at the beginning of each test session.
4. Stowing the iPad, case and stylus. (5 min)



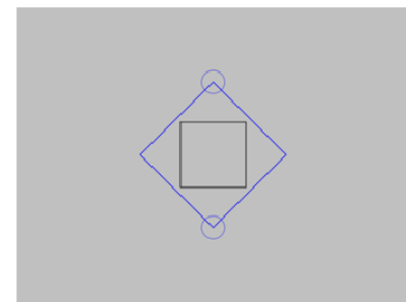
Pointing Task



Dragging Task



Tracing Task



Pinch-Rotate Task



# Importance of ISS and Potential Earth Benefits

- The ISS is the only environment providing the extended microgravity/gravitational transitions required for fine motor testing.
- Data obtained from this study will add to our knowledgebase and provide improved capabilities to judge the risk of fine motor performance decrements due to long-duration microgravity and gravitational transitions.
  - These data will contribute to closure of several NASA research gaps and may drive in-flight mitigations and design decisions for future vehicles and habitats.
  - These data will provide important complementary motor performance data to that being collected with the Functional Task Test (Bloomberg) and the Field Test (Reschke).
- The Fine Motor Skills application may be useful for measuring and potentially rehabilitating persons with impaired fine motor skills (e.g., elderly, patients with Parkinson's or brain injuries).



# Thank You

- Please contact project team members at any time.
- Fine Motor Skills team:
  - Kritina Holden (PI)
  - Shelby Thompson (Co-I)
  - Aniko Sandor (Co-I)
- ISSMP team:
  - Laura Sarmiento
  - Caitlin DeMeritt

